

Modeling Amerindian Sea Travel in the Early Colonial Caribbean

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Abstract

It is difficult to discuss pre- and early post-European contact life in the Caribbean. In part, this is due to the nature of European record keeping, which often failed to fully capture Amerindian practices. Archaeologists have long attempted to resolve these difficulties through the analysis of early colonial Caribbean materials and objects that reflect both Spanish and Amerindian influence. Through the use of computer modeling it is possible to approach this issue from a new perspective, that of discerning mainland–island or inter–island connections across the pre–Columbian and historic divide. Modeling hypothetical canoe routes based on the location of inhabited sites (between 1000 AD – 1550 AD) across Trinidad and the mainland coast of South America towards the Windward Islands can help to explore possible avenues of travel that were changed or interrupted during the early colonial period. This paper will approach this debate by looking for the location of early colonial Amerindian sites and determining if connections between them would reflect use of European influenced areas in this region.

Es difícil discutir la vida colonial en su etapa inicial en el Caribe. En parte, esto se debe a la naturaleza de los registros europeos, que a menudo no lograron capturar completamente las prácticas amerindias. Los arqueólogos han intentado durante mucho tiempo resolver estas dificultades mediante el análisis de materiales y objetos del Caribe provenientes del período colonial temprano que reflejan tanto la influencia española como la amerindia. A través del uso o modelado por computadora, es posible abordar este tema desde una nueva perspectiva, que distingue las conexiones entre las islas y el continente o entre las islas a través de la división precolombina e histórica. El modelado de las rutas hipotéticas de canoas basadas en la desaparición o aparición de sitios entre Trinidad y la costa continental de Sudamérica hacia las Islas de Barlovento puede ayudar a explorar posibles vías de viaje que fueron cambiadas o interrumpidas durante el período colonial temprano. Este artículo aborda este debate explorando la ubicación de los primeros sitios amerindios durante el período colonial temprano y determinando si las conexiones entre ellos pudieran reflejar esfuerzos para evitar las áreas controladas por Europa en esta región.

Introduction

Considering the written record is a vital component in evaluating the effect of early colonial encounters on Amerindian life in the Caribbean. Documents that reference Amerindian practices provide insight into everything from foodstuffs to the basics of canoe use or construction (ex. Benozzi 1563; Columbus 1498; Mendez 1933; Oviedo Valdes 1851). In turn, there are some detailed references to the movement of these, and the people who used them, between different islands. The specific routes by which these goods moved, and their alteration after the arrival of Europeans, are unfortunately difficult to trace through text and traditional archaeological analysis alone. Inconsistencies in the areas of coastline surveyed, the small number of objects relating to seafaring toolkits documented in the archaeological record, and the limited references concerning the specifics of canoe use by Amerindians in the historical record make these investigations challenging. Yet knowledge of the location of these pathways would help us understand specifics about Amerindian connections and social interactions not made explicit in the historical record.

Digital humanities approaches, or humanist theory as applied to or analyzed by computer applications, can provide a solution to this issue. Through the application of archaeological inquiry and computational analysis, the movement of materials and peoples in this region can be modeled as representations of past canoe routes between two points.

These generated routes can offer insight into connections that developed long before Columbus' arrival and continued as prime canoe pathways after European colonization. The trajectory of canoe travel corridors, or the routes people followed by South American mainland and Lesser Antillean communities were likely altered by European contact (1498–1650 AD), something that is unlikely to be represented explicitly in historical texts.

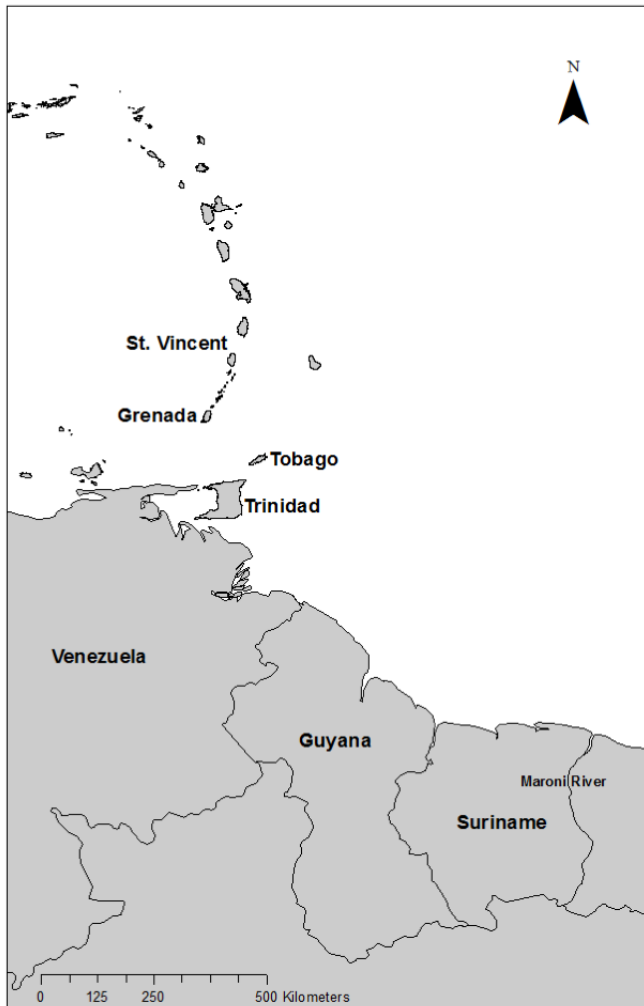


Figure 1. Map of the case study region, including Guyana, Trinidad, Tobago, and the Windward Islands.

To explore the location heavily used for voyaging by Amerindians I modeled hypothetical canoe routes between communities in contact, as referenced in the historical or archaeological record. Specifically, I used least-cost pathway analysis to determine travel corridors taking the least amount of time that may have existed. Such methods are drawn from previous landscape models (ex. [Bell and Lock 2000] [Conolly 2006]) and seascape [Callaghan 1999] [Callaghan 2001], which rely on algorithms to calculate these time costs. In many cases, these algorithms are either A* or Djekstra [White and Surface–Evans 2012] and tabulate the cost to movement by adding the difficulty of moving between regions of topography together until the lowest value between two points on a map can be determined.

The area from the north coast of mainland South America to the Windward Islands provides an interesting perspective for this approach. Though contact with Europeans in the Caribbean occurred in 1498, Amerindians were still using traditional seafaring lines well into the 1700s. Contacts between Amerindian peoples from South America and Europeans as referenced in early colonial accounts and the archaeological record, were taken alongside modeled least-cost pathways that consider the areas where interaction between these communities may have taken place. The results of route modeling are used to evaluate where and to what result Amerindians' travel corridors may have related to Europeans into the region. These efforts can help to provide a base for further analysis of Amerindian culture across the pre-Columbian and historic divide.

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Routes Demonstrated in Pre–Columbian and Historical Record in the Caribbean

Seafaring practices covered the maintenance of a complex web of social and material mobility networks that linked these communities. When the Europeans arrived in the Caribbean at the end of the 15th century, peoples from the north coast of South America to the Windward Islands formed complex groups of multi–lingual and multi–ethnic individuals [Boomert 2010] [Hofman and Carlin 2010] [Keegan 2004] [Watters 1998]). These cross–island/mainland relationships were built on the sea, and the connections and materials that could be gained by traveling it. This often meant that island communities were more focused on inter–island rather than intra–island connections (see [Boomert 2010]). Excavated sites dating to the colonial period possess materials that suggest substantial interactions existed between peoples on different islands [Keegan and Hofman 2016].

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Though the evidence used as the base for the discussion in this paper primarily comes from the archaeological record, we also see support for these connections in ethnohistoric accounts. The first written information about peoples from Trinidad and Tobago appears in the logs of Columbus' third voyage in 1498 [Columbus 1498] (see also [Boomert 2016, 61]). Later writers reported on Spanish efforts to take over the Orinoco River area as well as the islands off what today is the Venezuelan coast (Boomert 2016). Due to their proximity to Amerindians, these early chroniclers were thus able to view the comings and goings of seafarers between specific regions and islands, accounts often document the location of prominent canoe travel corridors used by Amerindians moving from the mainland to the Windward Islands and back. One of the earliest records of such a voyage comes from Columbus on his first voyage, where he mentions abducting a man mid-voyage between two points. Others also have made note of these types of voyages. Raymond Breton wrote during his stay on Dominica (1635):

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They are descended from the people of the mainland closest to the island... The friendship they maintain with them and their commerce with them are signs of it. [Breton and la Paix 1926: 45–46] [Davis and Goodwin 1990, 39].

Though these records are not from the region in question, it does set an example for Europeans meddling in Amerindian transportation routes from the time of initial contact. Breton, in addition to mentioning voyages near Dominica, recounted that South American Kaliña had branched out from their coasts to colonize the islands [Davis and Goodwin 1990]. Others disagreed and considered these connections between Island Carib peoples on St. Vincent at the period in question were mere associations and not deeper ties, as suggested by de Rochefort [Davis and Goodwin 1990]. Another example comes from reference to contact between peoples of Trinidad and Grenada by Dutch sailors in 1628 [Boomert 2002] [Boomert 2016, 73] [Laet 1931].

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Historical accounts also mention canoe crews using Tobago as a waypoint on their way to raid Arawak communities on the mainland [Boomert 2002]. The governor of Tobago in 1654 noted that both mainland Kaliña and island Kalinago canoers used the small island as a rest area for traveling between the two regions (Mollens, in [Mattiesen 1940, 452]). The governor of St. Kitts, in the late 1620s, suggested it was too hazardous to colonize Tobago because of the number of Carib vessels traveling by the island [Boomert 2002]. What is clear, even in the historic record, is that these groups were linked. Information concerning the movements of Amerindian peoples within these European sources can provide insight into past practices of Amerindian seafaring, as well as context for connections shown by least–cost pathway modeling.

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Historical records from early contact periods can also be problematic, not only because they often ignore large portions of Amerindian culture, but also because what they do mention often paints only the vaguest of pictures. For example, while canoeing Amerindians and their watercraft were popular topics for European chroniclers, reports about specific construction techniques or navigation practices were often glossed over. Likewise, none of these documents included detailed description of Amerindian canoeing activity. Most often they simply referred to the speed, size of the vessel or crew, and rough design of the canoe (ex. [Columbus 1498] [Benzoni 1563] Bernáldez, in [Jane 1988]), without discussing specific details about construction or navigation practices. For example, Columbus describes seeing Amerindians in a large war canoe, or pirogue, holding 25 men off the west coast of Trinidad in his 1498 dairies

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[Columbus 1498] [Columbus 1824] [Boomert 2016, 73]. However, the full picture of the technology and canoeing strategies goes unmentioned. Others also go into detail about the great length of these vessels, some extending 26 paces. Depictions of canoes seem to indicate that pre-Columbian travel was conducted without the use of sails. This absence would have limited the reach of seafarers, making their voyages targeted to areas within paddle distance of coastlines. It is from these limits that we can discern a base for modeling watercraft and site locations to retrace routes referred to by European chroniclers and observed in the archaeological record. It is in the margins or sparse commentary that researchers must look to contextualize what is found in the archaeological record.

While colonial records provide possible insights into pre-Columbian seafaring technology, the introduction of new technologies and people into the region began to alter inter-island relationships. There were changes in technological toolkits, such as the sporadic adoption and adaptation of the sail [Fitzpatrick 2013] [Mckusick 1960]. Tracking population fluctuations and movement to new settlements, and the role of European contact in these developments, can show regional changes in relationships [Keegan and Hofman 2016]. The decline of island populations because of the impact of forced removal of the populations and the spread of disease also influenced the construction of regional mobility patterns.

Record of this movement was not always positive. Interaction between Amerindians and Europeans often resulted in violent encounters. The fact that Tobago remained free of colonization until midway through the eighteenth century, in part due to persistent attacks by Kaliña (mainland Amerindian communities) and Kalingao (Windward Island Amerindian communities) peoples from the Windward Islands [Boomert 2010] [Keegan and Hofman 2016], speaks to its importance as a waypoint along the mobility corridors connecting mainland and island communities. That control of the eastern side of Trinidad remained difficult for Europeans [Boomert 2010] also points to the desire of Amerindians to keep these travel corridors clear. These waypoints, or areas where there were safe portages for canoes, needed to be preserved to maintain the connection between Kaliña and their island Kalinago counterparts (see Figure 2).

As time passed, it is probable that Amerindians canoeing between the islands sought to minimize contact with Europeans. These patterns of avoidance may have been based on techniques learned from previous generations, as many of the groups in this region participated in raiding of other settlements [Boomert 2016] [Moreau 1992] [Newson 1976] and possibly learned evasive maneuvering. The placement of canoe corridors may have centered on whether they took paddlers near to or away from coastlines, either to take advantage of an easy rest point or to avoid contact that may lead to an unfavorable result. In the case of the early European contact record, the location of interaction around the island like Margarita for pearl fishing, could have reinforced links moving to the eastern coast of Venezuela to the islands, which was a popular travel corridor prior to European contact, as referenced in the archaeology.

Though the historical record provides some information on Amerindian mobility corridors, the majority of evidence for direct contact between peoples of this region comes from the archaeological record. Materials — mostly ceramics — that connect sites on different islands tie stylistically to designs developed on the mainland [Boomert 2016] [Hofman and Hoogland 2011].

The Amerindian peoples of the Windward Islands were influenced by several avenues of exchange, both from the islands in the north and the mainland in the south (see [Allaire 1990] [Boomert 2002] [Boomert 2016] [Hofman and Hoogland 2011] [Keegan and Hofman 2016]). Similar styles of ceramic vessel shapes and decoration can be seen between ceramics found in the Guianas, or Koraibo ceramics, and in the Windward Islands, or Cayo ceramics, that date to periods directly before and after European contact (1250–1600 AD) [Bright 2011] [Davis and Goodwin 1990] [Kirby 1974]. Comparable shapes include Cassava brewing ceramics, for example, which can be found in both Kaliña and Kalinago assemblages [Boomert 1986]. Stylistic similarities include adornos, or ceramic elements adorning vessels, fashioned in anthropomorphic motifs and found on the upper sections of ceramic objects [Antczak and Antczak 2006]. Rim decoration, common in mainland Koriabo ceramics, found on Late Ceramic Age (AD 1200–1500) and early colonial period (AD 1498 to 1600) island-produced wares from Guadeloupe to Tobago, also indicate a connection [Boomert 1995] [Bright 2011] [Petersen et al. 2004].

Island-made Cayo ceramics likely resulted from local attempts to fit within macro-regional interaction networks [Bright

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2011] [Hofman 2013] [Slayton 2018]. In fact, the rise of Cayo style vessels largely coincided with the inception of mainland Kaliña materials, also known as the Koriabo style [Evans and Meggers 1960] [Van den Bel 2015]. Cayo ceramics have been considered a simplified version of Koriabo ware [Boomert 1986] [Keegan and Hofman 2016]. Currently there are roughly 20 sites that possess Cayo ceramics within the Lesser Antilles [Hofman and Hoogland 2012], the majority of which are centered around the islands of Grenada and St. Vincent. Replicating these connections through least-cost pathways should center on modeling routes between Cayo sites on Grenada or St. Vincent and the area off the coast of Guyana, following the trajectory of both stylistic and linguistic transfer, including references to canoe-centric names or to shared words around travel or connection [Boomert 2016]. For example, the connection of settlements and canoe use is indicated in the term “hueitinocou”, meaning both villager and member of a canoe crew [Hofman and Hoogland 2011]. That these patterns are noted in the archaeological record and by Europeans throughout the early contact period points to the longevity of these travel corridors, despite possible “adversarial” encounters between Europeans and Amerindian groups.

These systems of interactions and mobility corridors stemmed from routes created during early micro- and macro-regional explorations that brought migrating communities from the South American mainland into the islands [Hofman and Carlin 2010] [Keegan and Hofman 2016]. It is likely that avenues of movement developed as lifelines for Amerindian island settlers [Hofman et al. 2007] [Keegan 2004] [Hofman and Carlin 2010] [Kirch 1988] [Watters 1998] and solidified into deeper patterns of use for the exchange or raiding practices described by Europeans after 1500. However, as pointed out by Hofman and Carlin [2010, 111], the maintenance of these networks was tied to the shifting priorities of Amerindian communities both in the islands and on the mainland. These shifts were based on a desire to adapt social ties, develop avenues of exchange, or to engage in conflict. Therefore, a discussion of the location of routes modeled from around the northern coast of mainland South America past Trinidad or Tobago towards the Windward Islands furthers our understanding of the location of travel corridors from long-standing exchange patterns to those encountered by early colonial visitors.

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Methods

The physical processes of moving through the Caribbean have traditionally been evaluated through ethnographic and historic accounts. For example, many researchers refer to the ease of movement linked with following known environmental patterns, such as the South Equatorial or Guiana Current, and the prevailing northeastern trade winds associated with movement to and from Trinidad [Agard and Gobin 2000] [Boomert 2009, 64]. Adding lines of evidence for movement through computer-based modeling allows us to ask new, more detailed questions about connections between Kaliña and Kalinago communities. When combined with traditional text-based and archaeological analysis, modeled movement between these areas is an important aspect of the broader analysis of social networks in the region, both pre- and post-European contact.

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The routes analyzed here can be tied to the theory of least-cost pathway analysis, in which pathways are generated based on the cumulative effort of either the caloric or time expenditure it takes to travel from one geographic point to another [Bell and Lock 2000] [Herzog 2013] [Llobera 2000] [Tobler 1993]. Least-cost pathway analysis is a common technique used in archaeology to evaluate possible connections between sites. The method is often applied to movement through landscapes, where the cost of the journey is tied to movement with or against slopes within a terrain (e.g., [Bell and Lock 2000] [Conolly 2006] [Llobera 2000] [Lock and Pouncett 2009] [Tobler 1993]; [White and Surface-Evans 2012]). These methods are often based on Dijkstra's algorithm, which most commonly is used find the shortest paths from a fixed source point to all other grids within a raster surface, resulting in a shortest-path tree. These calculate the environment to assign portions of the area with a cost in time or energy, which then can be added together as a path is charted through these areas.

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In most cases, several least-cost routes are modeled between various points that correspond to archaeological sites within a landscape. These routes are then compared against existing knowledge and theory of connection in the area to draw conclusions about social relationships between sites. In recent years, interest in modeling this type of movement on waterscapes has increased, inspiring work on regional connections from the Pacific (see [Irwin et al. 1990] [Levison 1972] [Montenegro 2016]) to the Caribbean (see [Altes 2011] [Cooper 2010]). This interest is likely to grow as access to

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more robust and higher resolution climate data sets, both modern and reconstructed, become available.

Previous work in the Caribbean region has largely focused on analyzing models of large scale migration or colonization routes. Richard Callaghan [Callaghan 1999] [Callaghan 2001] has completed extensive work in this area, describing migration and travel patterns for both drift and non-drift voyages from the coast of South America to the Greater Antilles, as well as along the South and Central American coast. Others who have followed in his footsteps have either focused on similar scales of migration [Altes 2011] or similar areas, such as the Greater Antilles [Cooper 2010]. The goal of this paper is to explore maintained relationships between island and mainland communities at a finer scale and in as yet little modeled areas in the Caribbean using this underutilized digital method (see also [Slayton 2018]), to compare with the historic and archaeological record.

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For this work, I applied an isochrone approach to least-cost pathway modeling to examine seafaring routes. An isochrone method simply refers to a model that evaluates movement over the generated environmental surface based on where an “agent,” or individual, can move within a particular set time (see [Hagiwara 1989] [Hildenbrand 2015] [Slayton 2018]). Here I use the modified isochrone method, as based on Hagiwara, where movement is calculated using a variant of Dijkstra's algorithm. Specifically, I focused on the distance it is possible for a modeled canoe to move from where the boat was launched within a set time period. Although many possible directions of travel are evaluated, consecutive route segments are chosen based on the direction of travel where the canoe can move the furthest during the set time period [Slayton 2018] derived from calculations using modified isochrone method based on a global understanding of the environment or the anticipation of all possible routes. This process is repeated until the landing point — in most cases a known settlement area — is reached. These segments are then linked together to form a continuous route that suggests where it would have been easiest for canoes to travel between two points (see for example Figure 2).

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As such, routes can reflect traditional navigation practices, as seafarers may have reevaluated their boat's heading several times during a journey, which is reflected in the length of time between isochrone generations in the model. Keeping with the theme of modeling hypothetical travel corridors taken by real world canoers, there was an option to set a canoe speed within the model. This speed is reflective of the paddling power of those on board. Here, the canoe speed was set at 3 knots (see also [Slayton 2018]) or the typical speed achieved by canoers on experimental canoeing voyages in the region ([Bérard et al. 2016]).

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I used modern day environmental data, such as current and wind direction and strength, as the base for the surface on which these segments were modeled (see [Slayton 2018]). Specifically, surfaces were based on modern environmental data captured for the Caribbean Sea; water current data was gathered from the National Oceanographic and Atmospheric (NOAA) Amseas 3D program and wind data from the NOAA Global Forecast System (GFS) (for a more detailed discussion see [Slayton 2018]). These two data sets have a particularly robust iteration period, i.e., the time intervals over which environmental data is captured; new current or wind is data generated which allows for the model to evaluate updated currents every three hours. Additionally, the Amseas 3D program captures information every 3 km², while the GFS can only return information in 25 km segments. As a result, the tool includes a function that allows for these surfaces to be interpolated, or meshed, together. In this way current and wind are both reflected in the underlying surface on which the route segments are based on.

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Though sequential modern current data was used as the base for this analysis, it is important to note that others have used randomized or past-forecasted climate data. However, due to the lack of change in bathymetry (or under water topography) in this region, combined with the relatively stable current and wind data from the periods discussed [Callaghan 2001], modern data was deemed acceptable due to the high rate of iterative data provided by NOAA. Using this type of current data is also effective due to the geographic unit and time iteration of the NOAA models, as it allows for a finer resolution within the cost surface than has been used in other examples where nautical sailing charts were used [Callaghan 1999] [Callaghan 2001].

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Additionally, this iterative data allows for the capture of extreme weather (ex. hurricanes) in the return of high cost routes. In the future, more types of environmental constraints (i.e. wave height) should be considered. In keeping with

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the iteration period of both data sets, routes were modeled every three hours, during the months of January, April, August, and November due to the seasonal fluctuations observed in the underlying data sets (see [Slayton 2018]).

Routes modeled were connected to the Amerindian and European contact period by using launch and landing points known for their extended use leading up to and directly after the contact period. Though not to be taken as an exact representation of the past, routes modeled in this way can suggest avenues of contact between mainland and island Amerindian communities.

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Due to limitations with the extent of the underlying data set used to model these travel corridors, I was unable to model routes directly from communities from the southern Guianas. By viewing routes modeled from an area at the farthest extent of the underlying environmental data set, however, it was possible to evaluate routes that passed by large areas of Guyana that were inhabited by Kalifña peoples who were likely in contact with island communities. Routes examined in this study were modeled from off the coast of Guyana (Figures 2 to 5). In order to ensure efficiency in comparisons for this work, routes towards only sites on only two islands, Grenada and St. Vincent, will be discussed.

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Routes for this paper were taken from the author's PhD research on movement to and from the coast of Guyana and the Windward Islands [Slayton 2018]. The evaluation of these routes centers on how they can be used to hypothesize the location of known connection points and on how peoples following these mobility routes may have reacted to European arrival. As such, examples of routes referenced here (Figures 2 to 5) were chosen for their relationship to point of contact between newly-arrived Europeans and established Amerindian travel corridors mentioned in the ethnohistorical record (ex. Mollens, in [Mattiesen 1940, 452]). Due to limited space provided by this article, I will briefly discuss two examples of travel corridors modeled from the South American mainland to the Windward Islands using this qualitative analysis.

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Modeled Routes and Comparisons to the Historical Record

Examples of European style pottery within site depositions on Grenada and St. Vincent [Bright 2011] indicate that some level of exchange was being sought by Amerindian peoples to acquire these materials, even if they indirectly acquired them through down-the-line exchange with other Amerindian groups. Amerindian-produced pottery also indicates the strength of these ties, showcasing the longevity of contact between mainland and island communities. Stylistic motifs used in Kalinago pottery are viewed as connected to those produced by mainland populations [Davis and Goodwin 1990]. Modeling these corridors, established through connections recognized from archaeology and the historic record, we can begin to assess possible travel corridors which carried these peoples and materials.

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One of the travel corridors analyzed in this paper suggests movement along the coast of Tobago, while the other looks at movement towards the northern coast of Venezuela, where Amerindian canoers were more likely to have encountered the newly arrived Spanish. As mentioned above, routes were modeled between sites from suspected Cayo sites dating to AD 1250–1600 [Boomert 1986], which in some cases overlapped with European arrival. This allows for a brief discussion of the differences in contact opportunities for peoples along each possible corridor.

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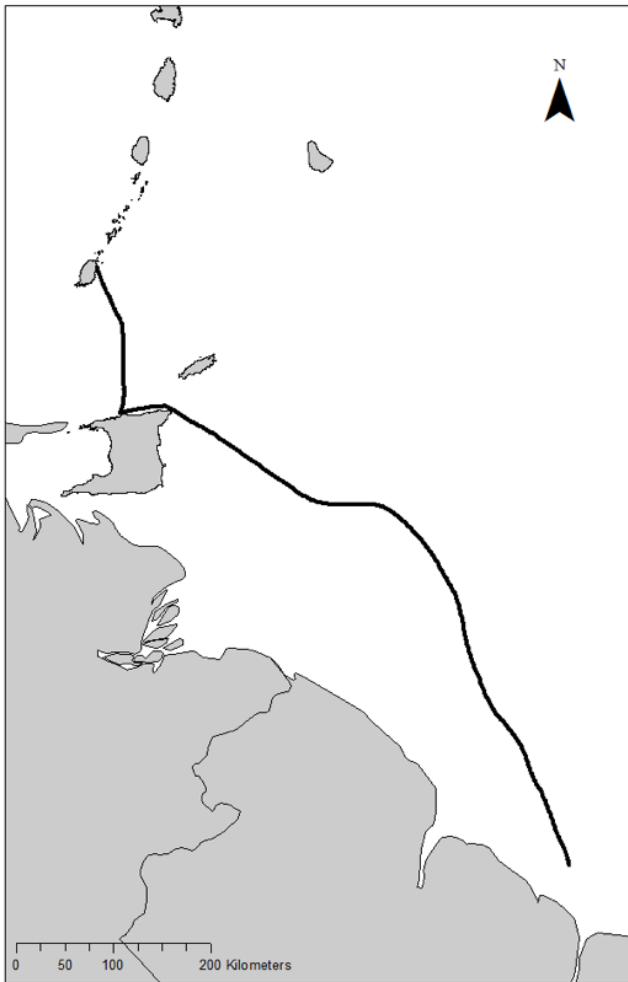


Figure 2. Modeled isochrone route between the Guyana and the east coast of Grenada launched November 17 at 3 pm [Slayton 2018, (Appendix D) 68].

The travel corridor over the north coast of Trinidad towards the northeast coast of Venezuela was indicated by several routes modeled between the Guianas and the Windward Islands. Movement along the north coast of Trinidad was likely a crucial aspect of the mobility network around Venezuela to the Windward Islands. This is due in part to the ability for persons to see the Windward Islands from the northeast coast of Trinidad [Boomert 2009]. Routes that pass by the northern coast of Trinidad commonly travel past the eastern coast of the island as well. The separation of communities from the western and eastern sides of the island is evident in both the archaeological and historic record [Boomert 2016]. This may have played into preferences for routes that avoided the western half of the island as well, in connection with later notes on island habitation from colonial sources.

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The acknowledgment of Tobago being used as a through–point of connection, both in the archaeological record and by European Governors of St. Kitts and Tobago, indicates that in some cases avoidance of Europeans was not possible or sought out. In addition, routes modeled from Guyana run directly past the site of Blanchisseuse, possibly highlighting the importance of finding natural rest points along routes [Slayton 2018]. In the case of Figure 2, the route ran directly into the area adjacent to the site. The placement of this circa AD 1200–1500 site supports the focus of peoples in this region towards inter–island connections, and the site may have acted as a waypoint for travel between Kaliña and Kalinago communities. Though use of this site was largely ended by the time Europeans arrived in this region, it does support the link between settlement use and the trajectory of routes returned by this model. The strong connection between the suggested routes and active use by Amerindians indicates that other modeled routes can stand in for past avenues of mobility. We might also ask archaeologists to question why natural stopping points used in earlier periods are not reestablished after European contact, as many sites or areas are typically part of a habitation season or cycle in

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the ceramic age.

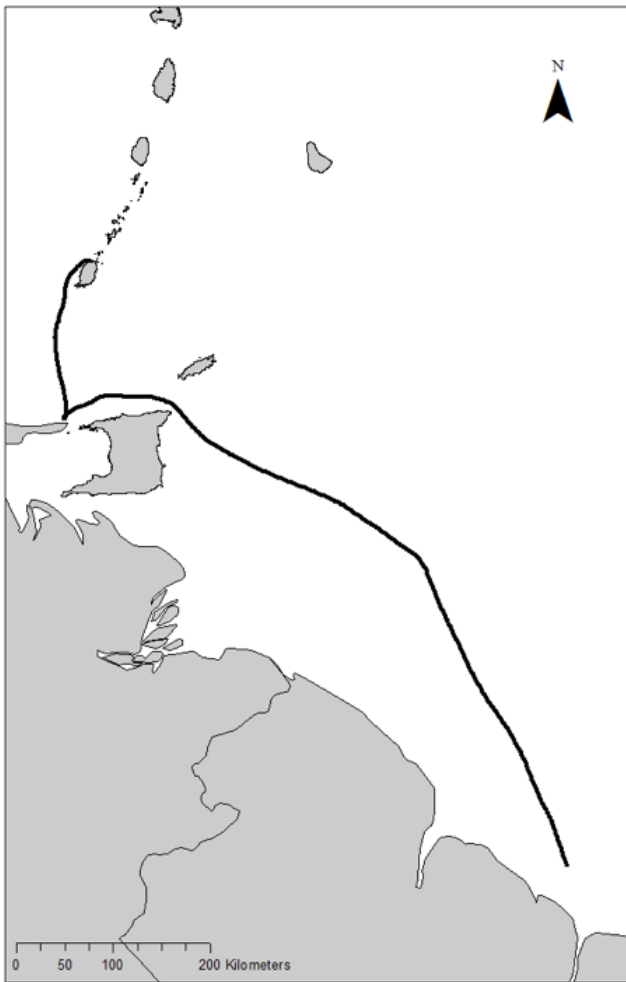


Figure 3. Modeled isochrone route between the Guyana and west coast of Grenada launched November 9 at 12 am, which connects with the Península de Paria [Slayton 2018, (Appendix D) 65].

Modeled routes following the trajectory in Figure 3 also go further to the west, keeping to the northern coast of Trinidad in its entirety and on rare occasions making contact with the Península de Paria. Peoples moving along more westerly routes could potentially have made contact with the active mobility corridors around coastal Venezuela. Pathways like these would also have brought peoples from Trinidad and the Guianas into contact with Europeans who settled within this region to gain access to pearl harvesting areas (see [Boomert 2016]). The intensity of use of these routes thus may have been altered due to this presence. This may explain why ceramics at sites like Blanchisseuse, inhabited or before conflict, show a change in this period. However, it may also be that increased raiding activity in the region or conflict between peoples on the west coast of Trinidad and the Venezuelan coast linked to this avoidance, as well. Re-evaluating routes within this mobility corridor, from the coast of Venezuela towards the Windward Islands needs to be done alongside considerations of materials found within the sites used as origin points needs to be done. It may help researchers to understand better if or when peoples traveled from the Guianas to the north coast of Trinidad post AD 1500.

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Another prominent corridor indicated by modeling routes between the Windward Islands and the area off the coast of Grenada covers the east and west coast of Trinidad (Figure 4). That many of the routes modeled between St. Vincent and Guyana's coast show movement past Tobago comports with the multiple references in the historical record that point to the island's importance to Amerindian peoples as a waypoint for travel between the Windward Islands and the mainland. These references make note of altercations between Amerindians and Europeans, where the former was

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perhaps intimidating the others who were populating Tobago [Boomert 2002]. Efforts to keep the island clear may have been linked to its prominence as a waypoint, with the need to protect travel corridors between Windward Islands settlements and the mainland “homeland” communities. That Tobago is referred to multiple times by Europeans as an Amerindian waypoint between these two regions further highlights the island’s significance.

The consistent movement of peoples past the island of Tobago, which was known by both Amerindians and Europeans to be a waypoint for Amerindian travelers, shows a commitment to this travel corridor. The strong response by Amerindians to protect Tobago, and its lack of European settlement until the late eighteenth century, indicates that these corridors of movement may have been only partially disrupted by Spanish settlement on islands off the Venezuela coast. Even the east coast of Trinidad remained relatively free of European influence, protecting through lines of traffic from disruption. As such, it is likely that only towards the eighteenth century did these routes truly suffer the full impact of outside influences.

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Routes that pass by Tobago originated in all points used for the start and end of voyages, both for the Guyana and the Grenada or St. Vincent start/end points (example Figure 4 and 5). This showcases the wide variety of peoples who may have taken advantage of stopping at this island. Unfortunately, there are still many stretches of Tobago’s coastline left to be surveyed by archaeologists and connections between specific mainland sites and those from the island are difficult to draw. In the future, areas that lie along modeled routes, areas of survey, and the specifics of European mentions of Tobago should be compared.

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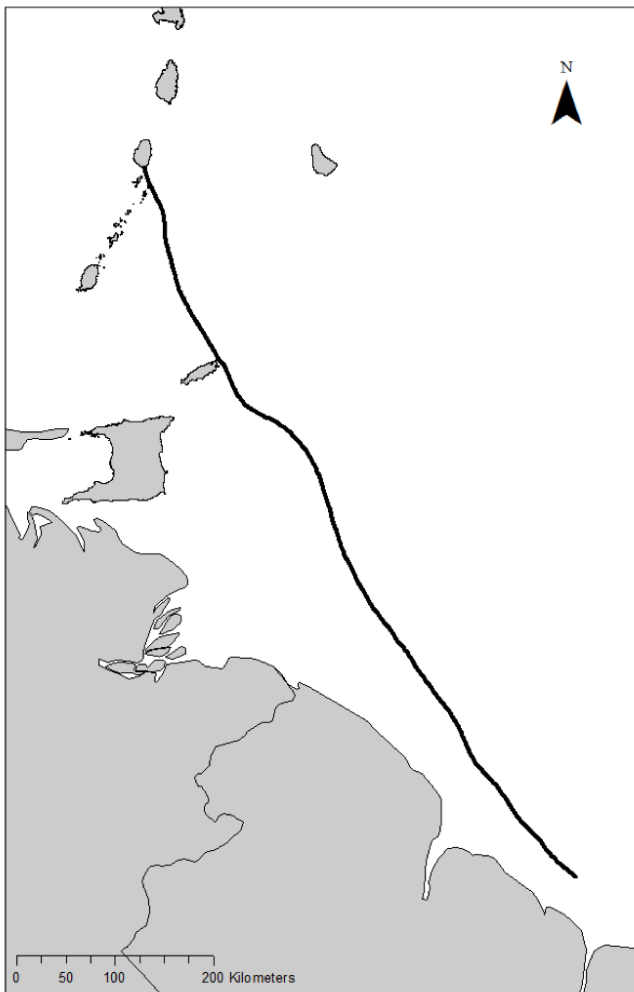


Figure 4. Modeled isochrone route between St. Vincent and Guyana launched November 15 from 9 pm [Slayton 2018, (Appendix D) Route 81].

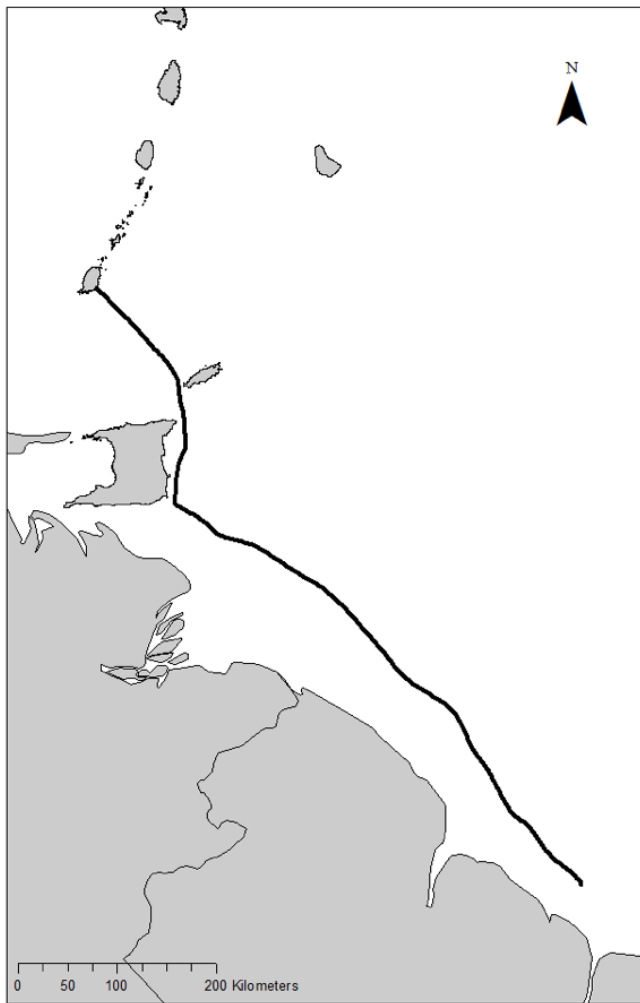


Figure 5. Modeled isochrone route between the Guyana and south coast of Grenada launched November 10 at 3 am [Slayton 2018, (Appendix D) 67].

It is also possible to evaluate the position of these routes not in terms of how they may have been affected by the presence of outsiders but by the efforts of Amerindian peoples to preserve them. The existence of these exchange and raiding corridors has been referred to as vital to the social structures of Amerindian Islanders. The desire to protect these connections was likely high and is conceivably reflected in the response of the Amerindians who fought to keep Europeans out of this area.

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Conclusion

This paper explores possible routes that connected the Late Ceramic Age/early European contact period Kaliña peoples of the mainland and the Kalinago peoples of the Windward Islands with the idea of connecting them to the location of canoe routes referenced within the ethnohistoric record of the early colonial period. Here, I specifically relate to the mentions of Amerindian peoples in canoes that pass the area between St. Vincent and Grenada between 1492 and 1650 AD. These references to the location of Amerindian travel corridors provide some insight into where Caribbean canoers paddled, but they only make up one brush stroke of the larger painting of these networks.

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This paper provides an example of how computational archaeology methods can act as a context for knowing the location of routes these comments were based on, as well as where these routes passed when out of sight of Europeans. The use of computational least-cost pathway modeling — a digital approach to humanities — is a vital addition to traditional modes of analysis of Amerindian mobility during this period. This is due to the limited European knowledge of the canoe routes that traversed this area. The methods used to generate the hypothetical canoe routes

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discussed above reveal new layers of understanding that would be impossible without computer modeling. These avenues of inquiry highlight the importance of using digital humanities techniques to supplement traditional text-based analysis.

The level to which these travel corridors remained in the minds Amerindians prior to or after the arrival of Columbus is unknowable. However, studies like these can provide a unique opportunity to examine the existing historical and archaeological record. The fact that the possible location of these corridors in some cases lie close to known archaeological sites from this period support some preliminary theories as to the underlying process of movement between these groups. However, to what extent Europeans encountered Amerindian peoples, and vice versa, cannot be learned through modeling alone. These modeled routes can only be discussed as a reflection of the singular least-cost path between two areas rather than as corridors reactive to social stressors. Further examination of textual resources, archaeological sites, and additional modelled routes needs to be conducted in order to determine if shifts in Amerindian population areas around the time of European contact met with them on the travel corridors that crisscrossed the expanse between the mainland and the Windward Islands.

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